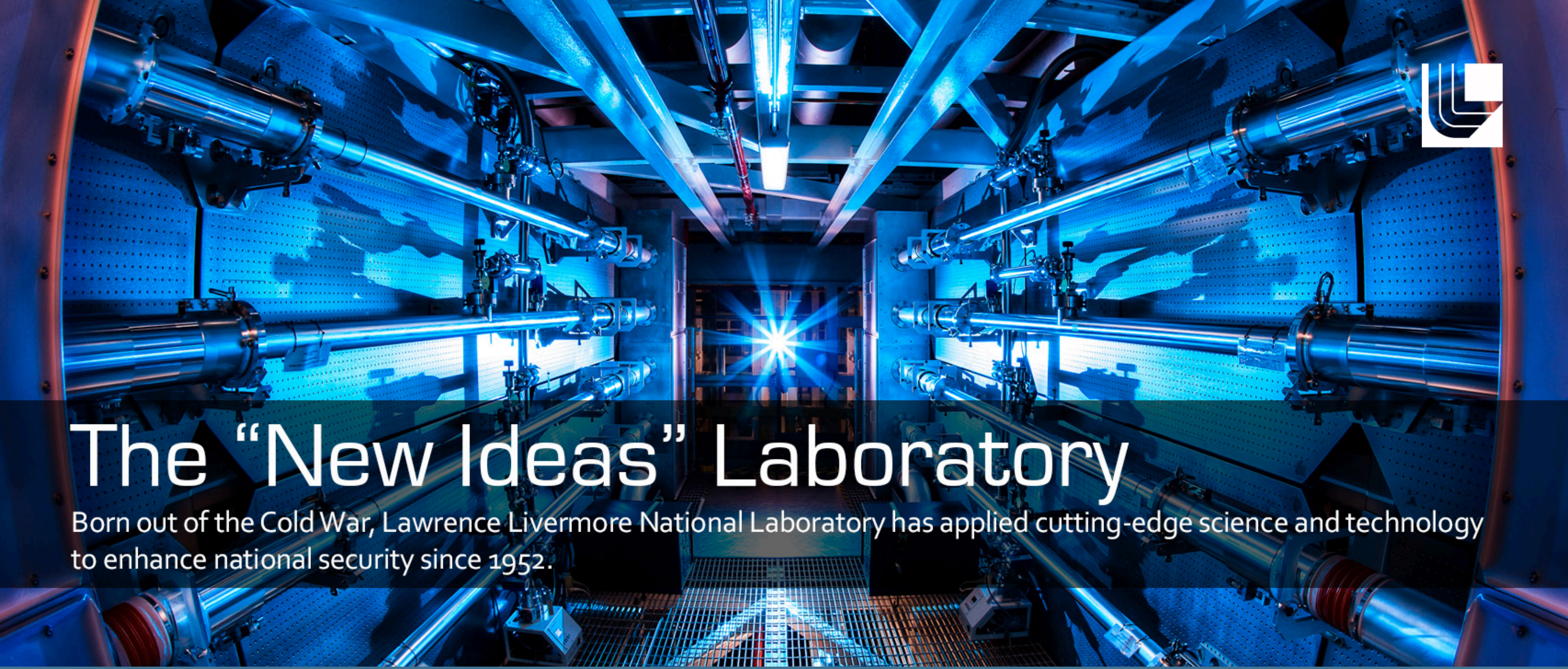


The “New Ideas” Laboratory

Born out of the Cold War, Lawrence Livermore National Laboratory has applied cutting-edge science and technology to enhance national security since 1952.

Seven Decades of Cutting-Edge Science

Lawrence Livermore National Laboratory (LLNL) was established in 1952 at the height of the Cold War to meet urgent national security needs by advancing nuclear weapons science and technology.

Renowned physicists E.O. Lawrence and Edward Teller argued for the creation of a second laboratory to augment the efforts of the laboratory at Los Alamos. Activities began at Livermore under the aegis of the University of California with a commitment by its first director, Herbert York, to be a “new ideas” laboratory and follow a multidisciplinary, team-science approach to research that Lawrence had pioneered on the Berkeley campus of the University of California.

Since then, LLNL researchers have conducted seven decades of cutting-edge science to meet national security needs.

1950s

Livermore made its first major breakthrough with the design of a thermonuclear warhead for missiles that could be launched from highly survivable submarines. For decades, the Laboratory led the development of high-yield warheads compact enough that several could be carried on each ballistic missile.

Livermore aggressively pursued advances in computer simulations to support nuclear weapons and other research activities, including fusion energy. After acquiring one of the first UNIVAC computers, the Laboratory subsequently drove industry’s development of and put to use increasingly powerful machines.

1960s

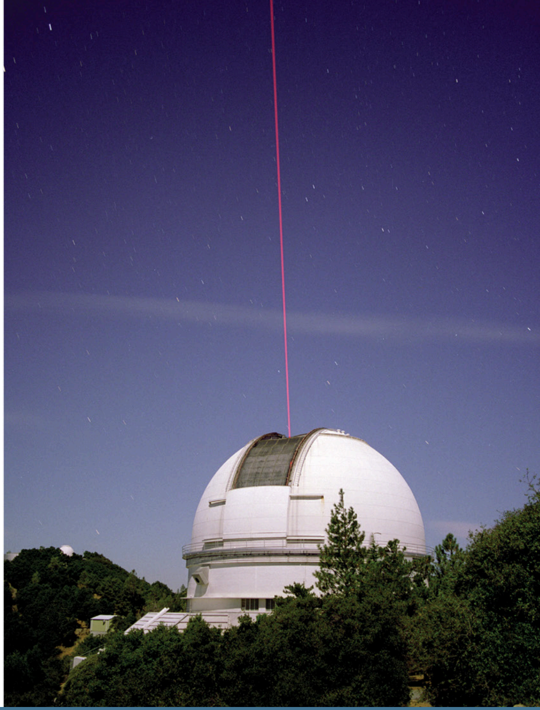
In addition to supporting nuclear deterrence, the Laboratory explored the peaceful use of nuclear explosives and made significant advances in magnetic fusion research. Strong research efforts in atmospheric sciences and a new bioscience program addressed concerns about fallout and the effects of ionizing radiation on human health. They later led to successes in genomic sequencing and sensors for biosecurity as well as capabilities for modeling atmospheric releases and global climate change.

Livermore also established a formal working relationship with the Intelligence Community (IC) to analyze Soviet nuclear test activities and develop technologies for the IC. That effort has continued to grow together with the IC’s need for all-source analyses of the nuclear programs in an expanding list of countries of concern.

1970s

The decade began with Livermore’s most ambitious nuclear test, the design of a high-yield warhead for ballistic missile defense. Keen interest arose in a new technology, lasers, as means for achieving fusion in a laboratory setting. LLNL’s Laser program has flourished and interest has remained high in ballistic missile defense. Scientists designed new weapons to enhance deterrence of aggression in Europe and they developed new explosives to improve the safety of nuclear weapons.

The energy crisis in the 1970s invigorated energy research programs, which continue to seek long-term reliable, affordable, clean sources of energy. Notably, Livermore scientists conducted important studies on the effects of human activities on Earth’s ozone layer and the newly developed Atmospheric Release Advisory Capability helped manage crisis response to the Three Mile Island reactor accident in 1979.



1980s

To help win the Cold War, Livermore developed a new strategic bomb and a new ballistic missile warhead for the U.S. Air Force. One of the needed computer simulation tools, DYNA3D, was transferred to industry and has been widely used to crash test vehicles. In support of the Strategic Defense Initiative, LLNL created the first x-ray lasers and developed small-satellite technologies that were deployed on the Clementine mission in 1994 to map the Moon. Laser science and engineering in support of national security and fusion energy applications advanced with the development and use of the 10-beam Nova laser system.

In 1987, Livermore bioscience researchers spearheaded DOE's launch of an initiative that would determine the entire sequence of DNA that makes up the human genome. LLNL had developed key chromosome-sorting capabilities to make genome sequencing possible, and DOE's effort evolved into the world-wide Human Genome Initiative.

1990s

The Berlin Wall fell in 1989, and LLNL helped DOE define the Stockpile Stewardship Program, which is ensuring the safety, security, and performance of the nation's nuclear deterrent in the absence of nuclear testing. Livermore provided leadership in achieving a million-fold improvement computing capability over a decade and began construction of the National Ignition Facility (NIF) to perform physics experiments at weapon-like temperatures and pressures. LLNL also pursued the development of analytical and detection capabilities to address the threat posed by weapons of mass destruction.

New world-class capabilities established at Livermore included the High Explosives Applications Facility, the Forensics Science Center, the Center for Accelerator Mass Spectrometry, and the Program for Climate Model Diagnosis and Intercomparison.

2000s

LLNL successfully completed a life-extension program for the nation's most modern ICBM warhead that will enable it to remain in the U.S. strategic arsenal well into the 21st century. Studies conducted at Livermore and Los Alamos concluded that the plutonium in weapons is aging gracefully. In addition, a new facility was constructed to house successive generations of powerful supercomputers, and NIF was dedicated in 2009.

LLNL programs in counterterrorism and counterproliferation gained impetus after the 9/11 attacks. Innovative technologies were developed to detect biological and chemical threats, explosives, and nuclear materials. Livermore researchers also contributed to the discovery of the first extrasolar planet and began work on the Gemini Planet Imager.

2010s and into the Future

Precision experiments and advances toward exaflop-scale computing are enabling the development of more predictive simulation models for stockpile stewardship. NIF is proving to be a remarkably flexible and valuable tool for creating conditions that exist in giant planets, providing data needed for stockpile stewardship, and progressing toward fusion ignition.

Innovations, based on advances in material science, range from plastic scintillators for radiation detection to biocompatible microelectronics and sensors for myriad healthcare applications. Livermore researchers' advances in additive manufacturing are creating materials with previously unimaginable properties and are providing a path toward more cost-effective production processes within the nuclear weapons complex, and more broadly, U.S. industry.

Images (left to right): delivery of Livermore's first supercomputer; development test of the Polaris missile; and laser guide star and adaptive optics to view exoplanets.

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